

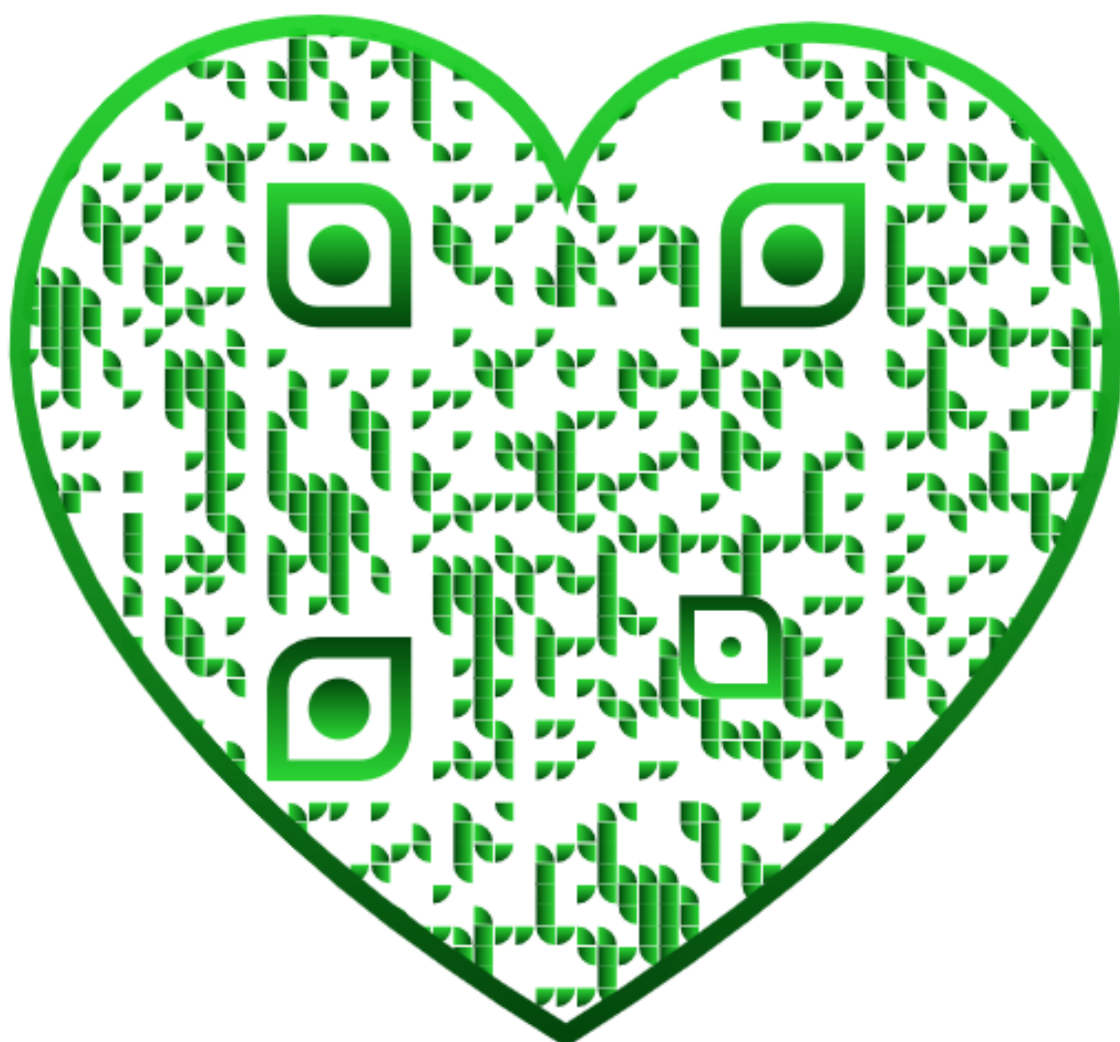
THE PACIFIC COAST'S MYSTERIOUS SEA STAR EPIDEMIC + FIVE MILLION TONNES OF TROUBLE

canadian **wildlife**



Long_{way} **home**

ARCTIC FOXES BRAVE THE COLD
TO FIND NEW TERRITORY



This mother is entangled

A newborn whale depends
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protection and life itself.
But when her mother is
entangled in fishing gear, both
futures hang in the balance.

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Photo by Anne Richard

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Curiosities Abound

NATURE HAS SO MUCH TO TEACH US ALL.

It can transfix our minds and break our hearts wide open. In “The Fragile Life of the Banff Springs Snail,” you’ll meet Brenna Stanford, whose life was changed when she studied a rare snail for her master’s degree — one that lives exclusively in a handful of hot spring pools in Banff National Park. Who wouldn’t be fascinated?

At the Canadian Wildlife Federation, we’ve been weaving connections between education and the wild world right outside your door for decades. We’ve championed experiential education: training teachers, encouraging young people to get outside and give back to their communities, and offering schools across the country the tools to build pollinator gardens in their own schoolyards. We’ve also encouraged all of you to tell your friends about the value of nature, take up wildlife-friendly gardening practices and even read this magazine to learn more about nature.

We know there is much more to do. All Canadians deserve the chance to learn about, from and in nature. That should be happening in classrooms, seniors’ residences, playgrounds, math classes and everywhere in between. Research shows this type of learning isn’t just good for the environment: it’s good education.

This job is too big for CWF to do alone. Countless people and programs across Canada are doing amazing work — you’ve seen some (like Brown Girl Outdoor World) in our annual awards. We have long championed the great work they’re doing, and we’ve connected Canadians to the people doing the best work. We’re now stepping up our efforts through a new ecosystem of partners and programs across Canada to make sure that every person, no matter their age or ability, has the chance to make real change.

We’re calling this ecosystem the Canadian Centre for Nature-based Education. This centre will nurture that same sense of wonder that transformed Stanford’s life, serving everyone with an innate desire to learn more

about our natural world, whether they’re an educator, a community leader or simply someone seeking to deepen their connection to wildlife.

We are going to make sure no one asking to engage in nature gets told that we can’t help them do it: if we can’t give someone a life-changing experience, we’re going to make sure we connect them with someone who can. Because enjoying nature should be a right for everyone who calls Canada home.

Part of the joy of being alive is that we get a chance to understand the curiosities of our natural world and our place in it every day. With love for the creatures we share this country with and the places they live, a conservation ethic is sure to follow. Just imagine all the vibrant minds in Canada tapped into that conservation ethic. We’d be unstoppable.

This same spirit of inquiry will also drive the future of *Canadian Wildlife* magazine. I’m happy to announce that April Overall is our new editor. April came on board at CWF 17 years ago, and her enduring fascination with this country is unflappable — she still believes Canada is one of the most fascinating places in the world, with starkly different landscapes and an array of wildlife that would put other countries to shame. But what truly excites her is what lies beneath the surface: every place and creature is teeming with stories waiting to be told.

I hope this issue and those you read in the coming months will spark a deep sense of wonder for Canada’s wilderness in each of you.



Sean Southey
Chief Executive Officer, CWF



MUSKOXEN

NUNAVIK, QUEBEC

"Spending time on the tundra with muskoxen; it was difficult to tell who was watching who."

Photo by Norrie Franko

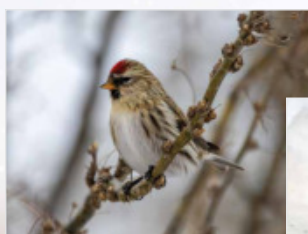
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**QU'EST-CE QUI LA REND
PARTICULIÈRE?**
Visiteuse estivale bien-aimée

HISTORIQUEMENT, LES BALEINES GRISES DU PACIFIQUE EST PASSENT LEUR ÉTÉ À SE nourrir d'invertébrés marins dans les mers de Béring et des Tchouktches, entre la Russie arctique et l'Alaska, puis, à la fin de l'automne, elles migrent vers le sud, vers les eaux subtropicales plus chaudes de la côte mexicaine, pour passer l'hiver à s'accoupler et à mettre bas. Pendant des décennies, les baleines grises ont fait le bonheur des observateurs de baleines au Canada lorsque ces mammifères marins longeaient la côte de la Colombie-Britannique au printemps et à l'automne.

Toutefois, ces dernières années, et plus particulièrement depuis le début des années 2000, un petit segment de la population totale a terminé sa migration printanière au large de la côte de la Colombie-Britannique. Cette petite sous-population, que les biologistes appellent le groupe d'alimentation de la côte pacifique, compte environ 200 baleines dans le nord de la Californie, l'Oregon et les États de Washington. Ces baleines se nourrissent de diverses proies, notamment de crevettes fantômes, d'amphipodes, de mysidacés ou de larves de crabes, ainsi que d'œufs et de larves de harengs du Pacifique dans les herbiers de zostères. Le Comité sur la situation des espèces en péril au Canada a évalué cette sous-population comme étant menacée en 2017 en raison de sa petite taille et du risque de collisions mortelles avec des navires, et de déversements d'hydrocarbures. La décision du gouvernement fédéral de l'inscrire ou non au registre des espèces en péril est en attente. —WAYNE LYNCH

*POPULATION DU GROUPE S'ALIMENTANT SUR LA CÔTE PACIFIQUE

SEA STAR SUPERNOVA

How researchers solved the mystery of the sea star epidemic

By Alanna Mitchell Illustration Diana Bolton

FOR YEARS, THE MYSTERY TORMENTED SCIENTISTS: WHY WERE sea stars along the Pacific coast wasting away by the billions? Now, after a decade of clues and dead ends, researchers have finally cracked the case behind one of the ocean's worst epidemics.

A weird flesh-wasting disease began to strike sea stars on the Olympic Coast of Washington in June 2013. By that summer, it had skulked south to central California and north to the Salish Sea of British Columbia before creeping remorselessly to the bottom edges of western Mexico and up into Alaskan waters.

Before it was done, it had turned billions of sea stars across more than two dozen species into piles of goo, the biggest documented animal epidemic, or epizootic, of a non-commercial marine species ever recorded.

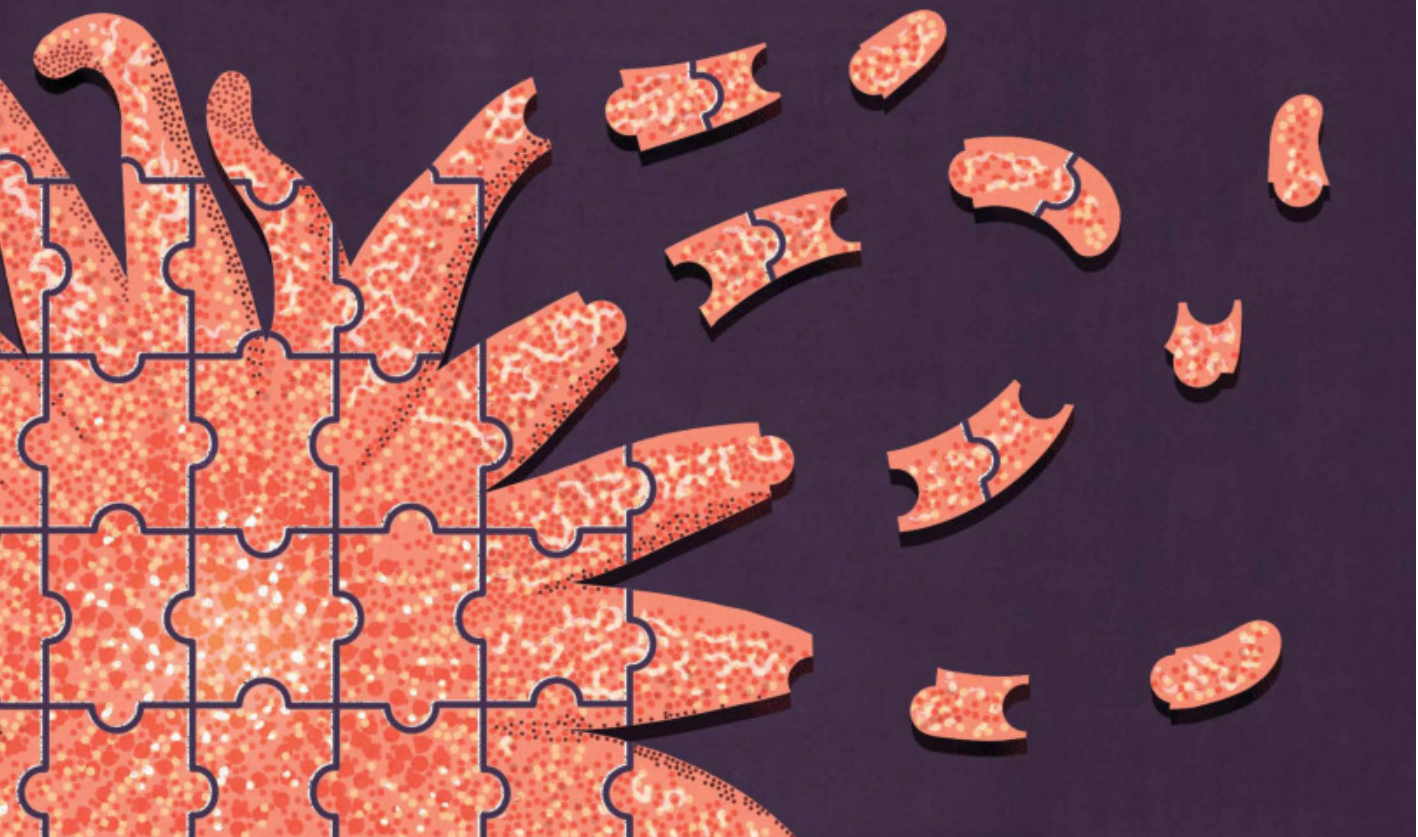
It hit sunflower sea stars, *Pycnopodia helianthoides*, the hardest. These metre-wide animals, named for their throngs of arms that resemble the sun's wriggly rays, are fast and effective predators of sea urchins and other shelled creatures. Billions once lived along North America's west coast. Today, they have all but vanished in their southern range and are grimly reduced in their northern range, including in the Salish Sea. The International

Union for Conservation of Nature has declared the species critically endangered, estimating the global decline as high as 98.6 per cent. And they keep dying.

For more than a decade, the cause of the sea star wasting disease remained a scientific mystery. Early analysis suggested a virus, but that was eventually ruled out. Now, after four years of painstaking collaborative sleuthing, scientists, including those at the University of British Columbia and the Hakai Institute of Campbell River, B.C., have found the culprit.

It is *Vibrio pectenicida*, a bacterium that is relatively new to science. Its first sighting was in 1998 in dying scallop larvae in an aquaculture hatchery in France. In 2000, it showed up in sick geoduck clam seed in an





FOR MORE THAN A DECADE, THE CAUSE OF THE SEA STAR WASTING DISEASE REMAINED A SCIENTIFIC MYSTERY

aquaculture hatchery in Washington — not too far from where the outbreak in the wild began — and after that, in seawater samples taken in Australia, Asia, Europe and the United States. Once they knew what to look for, researchers re-examined samples collected from wild sunflower sea stars during the original onslaught in southeastern Alaska in 2016 and found it there, too.

It's still not clear exactly how the bacterium spreads so lethally during an epizootic, except that it may do so in several ways. Researchers were able to purposely infect healthy sea stars in the lab in three ways: immersing them in infected water, injecting them with the coelomic fluid (a.k.a. sea star blood) of an infected animal and putting a healthy star in the same tank as a diseased one. What is clear is warmer temperatures, the result of climate disruption, make the bacterium more deadly.

Media headlines about the discovery were multitudinous and enthusiastic. “Scientists finally identify killer microbe

behind ‘terrifying’ sea star disease,” read the *New York Times*. Roughly 255 news outlets reported on the academic paper, catapulting it to the top five per cent of coverage of scientific articles, according to its Altmetric media score.

To me, all this is fascinating on several fronts. First, there's the sheer satisfaction of knowing that a complex, long-running detective story has ended well. Science doesn't always work that way. Sometimes, despite best efforts, we never actually find out whodunnit. In this case, the *Vibrio pectenicida* finding is definitive enough to supply the emotional punch we long for in every successful detective novel: the world feels like it's put back to rights, allaying the pain of tragedy.

And then there's the fact that this was such a strong group scientific effort. Fifteen scientists put their names to the paper, representing Canadian and American universities, a private Canadian institute and the U.S. government. Money to fund the study came from private foundations, a university and three levels of government on both sides of the border. It took a scientific team to track down this wily suspect.

There's a fundamental reminder in all this, too. It's that truth matters. That truth is out there to be found, if only we try hard enough. Truth is not imaginary or irrelevant or merely optional. Science rests on the principle that human knowledge builds on accurate information, empirically discovered.

In the case of the sunflower sea stars, we have to wait to see how this new finding can be put to use. Can we protect them? Here's the truth: knowing what causes the disease gives us the first tool we need to try. 🌊



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THE POL

By Kerry Banks Photos by John E. Marriott



ARCTIC FOXES PLAY A BIGGER ROLE IN THE NORTH THAN MOST PEOPLE REALIZE. AROUND THEIR DENS, WILDFLOWERS BLOOM, CARIBOU GRAZE AND SCAVENGERS FEAST, ALL FUELLED BY THE FOXES' HUNTING AND WASTE. AS THE ARCTIC WARMS, THESE ECOSYSTEM ENGINEERS FACE SHRINKING FOOD SUPPLIES, COMPETITION FROM RED FOXES AND AN UNCERTAIN FUTURE

LAR FOX



*Surrounded by playful
kits, an Arctic fox makes
the most of summer's
brief breeding season*





ARCTIC FOX DENS MAY BE UNDERGROUND,

but biologists can spot them from the air as they fly into their summer research camps in northeastern Manitoba. The sites are so distinctive they're visible in satellite images. "They appear as bright green patches on the tundra," says Sean Johnson-Bice, a post-doctoral fellow in biological sciences who is part of a team from the University of Manitoba that has been studying the Arctic fox for several years.

The remnants of the prey that the foxes drag back to the dens to feed their young, combined with their urination and defecation, fertilize the normally poor soil, creating a nutrient sink that supports plant communities with diversity up to three times higher than surrounding areas. These "fox gardens" feature abundant grasses, willows and flowering plants, attracting insects, birds and other animals. "Because they create these lush ecological hot spots on the tundra, we have classified Arctic foxes as ecosystem engineers," says Johnson-Bice.

The role of ecosystem engineers, a distinction more typically linked with beavers and bison in North America, is just one more documented attribute of an enigmatic animal whose existence is a testament to its adaptability and resilience. No bigger than a large domestic cat, the Arctic fox (*Vulpes lagopus*) manages to thrive in one of the harshest environments on the planet: a barren region beset with howling blizzards and ice storms, where temperatures can drop to -50 C and the land is blanketed in darkness for months at a time.

Despite such daunting physical challenges, the Arctic fox has one of the most extensive circumpolar distributions of any land mammal, inhabiting the Arctic regions of North America, Europe and Asia, with an estimated global population of about 600,000. Unlike many Arctic specialists, these foxes inhabit diverse terrains within the polar realm, from sea ice and coastal areas to inland tundra and

THE ARCTIC FOX HAS ONE OF THE MOST EXTENSIVE CIRCUMPOLAR DISTRIBUTIONS OF ANY LAND MAMMAL, INHABITING THE ARCTIC REGIONS OF NORTH AMERICA, EUROPE AND ASIA

mountainous regions, showcasing their ecological versatility. In Canada, the fox is found from the northern tip of Ellesmere Island to the southern tip of James Bay. Their population is stable in most of the Canadian Arctic, but their numbers are falling in southerly parts of their Canadian range, where the effects of climate change and competition from the red fox pose new threats.

The Arctic fox's ability to thrive in this hostile setting is due to several physical adaptations. One of the most prominent is its thick, insulating fur, which has two layers: a soft underfur and longer guard hairs. The underfur traps heat, keeping its body warm, while the guard hairs help repel wind and moisture. The fur changes colour from white in the winter to greyish brown in the summer, providing camouflage and making the fox nearly invisible to predators and prey alike.

Their paws are also covered with dense fur that helps insulate them from the cold and improves their traction on icy ground. As well, their compact bodies and short legs reduce their exposure to cold and prevent heat loss, and their bushy tail acts as a blanket, wrapping around them to provide extra warmth. Their small, rounded ears minimize heat loss, and they can survive without food for days, living off fat reserves when prey is scarce.

The fox's ability to withstand extreme cold puzzled the first scientists who encountered the animals in the wild. In 1950, the U.S. navy had an Arctic fox flown from Alaska to Washington, D.C., where researchers investigated its ability to withstand extreme cold by placing the fox in a cold weather chamber. For two hours at -50 C, it remained completely unfazed, even lying down and falling asleep.

At -70 C, it again went to sleep with no change in body temperature. At -80 C, it began to shiver after five minutes but showed no drop in body temperature during the one-hour test. As a result of these experiments, scientists concluded the Arctic fox is virtually indestructible in the face of any weather that nature can muster.

Seventy-five years later, scientists continue to regard the Arctic fox's cold tolerance with awe. Other of the species' mystifying abilities have been revealed only in recent years, largely thanks to enhanced technology. The invention of small satellite tracking collars has afforded scientists new insights into the Arctic fox's uncanny ability to travel long distances. The case that first brought this characteristic to light concerned a young female Arctic fox that left Spitsbergen, a remote island in the Svalbard archipelago, 1,151 km north of mainland Norway, on March 26, 2018. The fox was wearing a satellite-tracer collar so her movements could be followed by scientists at the Norwegian Polar Institute. When the tracking data started coming in, the researchers were stunned. In 21 days, she had crossed the frozen Atlantic Ocean to Greenland. From there, the canid sustained its Arctic trek all the way to Ellesmere Island in Canada.

Though her journey covered 3,506 kilometres end to end, she was tracked over a total distance of 4,415 km. She finished the trip in 76 days, arriving in Nunavut on June 10. The intrepid fox covered 46 km per day on average but travelled an incredible 155 km in one single day.

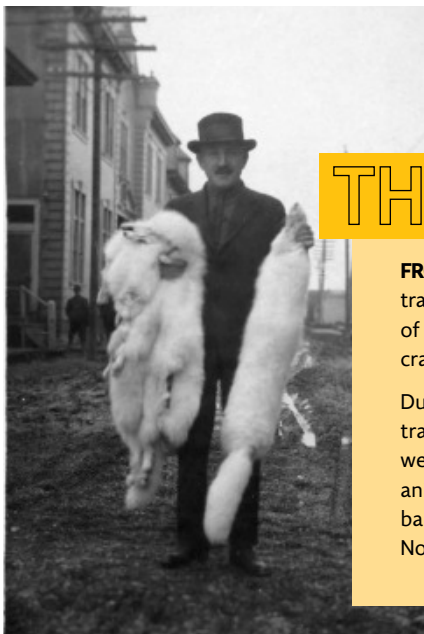
Scientists suspect the fox survived on marine food, like seabirds, en route before reaching Nunavut, where she could feast on lemmings. The trail ended there because





*An Arctic fox and snowy owl
blend nearly seamlessly into
the tundra's snowy landscape
Above: An Arctic fox on
Bylot Island*





THE FUR TRADE

FROM THE TURN OF THE LAST CENTURY TO THE EARLY 1930S, A FLOURISHING trade in white fox furs led to an economic boom for trappers and traders in much of the Arctic. Fox-fur wraps, coats and stoles were all the rage in Europe, a fashion craze that lasted nearly three decades.

During this period, millions of Arctic foxes were killed annually for the fashion trade. The trade had a devastating impact on Arctic fox populations in the western Canadian Arctic and in Scandinavia, where intensive hunting for the animal's prized pelt pushed them to the edge of extinction. Today, they are barely hanging on in Scandinavia. The total population estimate for Finland, Norway and Sweden is a mere 300 animals.

the tracker stopped working. Researchers have no definite answer as to why she made the journey, though they speculate she was looking to establish a new territory and find fresh food resources.

Arctic fox journeys have also been tracked in Canada by Dominique Berteaux, a biologist from the Université du Québec in Rimouski, Quebec. For the last 20 years, his team has been studying various aspects of Arctic fox ecology on Bylot Island, just north of Baffin Island. The research includes analysis of the predation of Arctic foxes on the 60,000 snow geese that breed and nest on the island's wetlands each year, the relationship between Arctic and red foxes, and the Arctic foxes' long-distance travels.

"We have found that Arctic foxes living on Bylot Island can move in winter throughout Nunavut and even beyond, to Greenland, Quebec and the Yukon. A few return to the same den the following year, but many never come back, as if they had been expelled from their territory by another, stronger fox," says Berteaux.

When moving through Nunavut, the foxes may cover 90 km in a single day, the equivalent to running more than two marathons. One fox that Berteaux's team tracked in 2019 covered an incredible 6,400 km in 299 days before reaching a new home.

Berteaux says these trips can be prompted by parents driving juveniles out of their home territory to reduce the threat of competition or by the juveniles looking for new territory or a mate.

For a study published in *Royal Society Open Science*, his team collared and traced the movements of 170 foxes from 2007 to 2021. Of the group, 37 foxes attempted epic

relocations across vast distances. Berteaux anticipated most would perish from predation, hunger or other perils. But 13 foxes beat the odds and established themselves in new territories.

Despite Bylot Island's location in the High Arctic, red foxes have also established a presence here. The normal habitat of red foxes is farther south in the boreal forest, but as Berteaux notes, "You will find that they show up near human settlements in the North." About one in 10 foxes on Bylot are red foxes. Berteaux wonders if this ratio will change with the climate warming and what effect that may have on the Arctic fox population. "The Arctic fox is better adapted for colder climates, but if the temperatures rise, the red fox takes over," he says.

A distant 1,700 km south of Bylot Island, researchers from the University of Manitoba have charted an even more pronounced invasion of red foxes into their study area in northeast Manitoba, a region that includes three distinct biomes: the Arctic tundra, the boreal forest and the marine environment along the shore of Hudson Bay. Arctic foxes here are in decline, a result of climate change, a drop in their food supply and competition from the red fox. Biologist Jim Roth estimates there are now only about 15 to 30 pairs of breeding Arctic foxes in his group's study area. "When prey availability is low, reproduction is often not successful, and many foxes disperse away from the area in winter. We think the population is about half as large as it was in the 1990s," he says.

Roth believes that a decline in lemmings, the Arctic fox's preferred prey, is a key factor. He says warming winters and increased rainfall have degraded the dry, fluffy

BECAUSE ARCTIC FOXES CREATE LUSH ECOLOGICAL HOTSPOTS ON THE TUNDRA RESEARCHERS HAVE CLASSIFIED THEM AS ECOSYSTEM ENGINEERS

snowpack quality that the lemmings prefer, impairing their ability to survive the winters. In the mid-1990s, lemming populations would number 12 animals per hectare — now it's two. "That's a peak year now," he says. "Which is just bizarre, given how important lemmings are."

In summer, the Arctic foxes have a plentiful supply of food, including lemmings, meadow voles, ground squirrels and eggs from nesting snow geese and Canada geese, but this stock diminishes sharply in winter. During winter, the foxes continue to hunt for lemmings, which are active under the snow, by using a technique known as "mousing," leaping high in the air and penetrating deep into the snow with their snouts. Other sources of nutrition include food caches, typically composed of dozens of bird eggs gathered by the foxes during summer.

In spring, Arctic foxes will venture onto the Hudson Bay ice to raid the snow caves that female seals construct to raise their pups. When the mother dives underwater to hunt, the foxes burrow into these structures and nab the seal pups. The foxes will also prowl the Hudson Bay ice to dine on the carcasses of seals left behind by polar bears. Their keen sense of smell can reportedly detect carcasses left by larger predators up to 40 km away. Rotting food does not appear to deter them. Canadian naturalist Fred Bruemmer once observed Arctic foxes "eating tunnels into the corpse of a 60-foot whale, until the colossal carcass resembled a Swiss cheese."

But this Hudson Bay food supply is now declining as well. "The sea ice is disappearing, the ice-free season is increasing and polar bear populations are declining, so there is less food for the foxes," explains Roth.

In Manitoba, the foxes usually have five to eight pups, but litters of up to 25 have been recorded elsewhere, the largest of any wild mammal. However, the average life span is only four years. "Pups die from starvation and predation by wolves, bald eagles, ravens and polar bears," says Johnson-Bice. "They have a live-fast, die-young lifestyle."

The dens in which the foxes raise their young are used for decades, perhaps even centuries. Large and complex, they can feature as many as 100 entrances and cover an area the size of a football field. However, they're not always in use. Researchers monitor about 80 dens within the greater Wapusk ecosystem, along the shores of Hudson Bay, and, within any given time, only about 20 to 50 per cent of them were used.

The dens are easily visible on the brown tundra because their domes are festooned with an array of green plant life, a product of the soil nutrition provided by the foxes' activity. The Manitoba scientists have discovered that once the foxes colonize a den, the green thumb effect persists long after the foxes leave, suggesting a long-term ecological boost. "Lots of animals visit these dens," says Roth. "Caribou and other herbivores are attracted to the lush vegetation, and scavengers come looking for goose carcasses."

In recent years, however, some of the dens are being occupied by red foxes. This development is cause for concern, as red foxes compete for food and can pose a physical threat. In Scandinavia, they have driven Arctic foxes out of their territory and even killed them. Roth says European red foxes are larger than those in North America, so it's difficult to equate the two situations. However, there have been clashes in Manitoba. In one notable case,



*An Arctic fox secures its catch to fuel its survival in the shifting Arctic seasons
Above: An Arctic fox wraps its bushy tail around its body for warmth*



a photo entitled “A Tale of Two Foxes,” taken in the snow near Churchill by Don Gutowski, depicted a red fox holding the bloody carcass of an Arctic fox in its jaws. The striking image won him Britain’s Natural History Museum Wildlife Photographer of the Year Award for 2015.

“We’ve seen videos that people have taken of red foxes killing Arctic foxes,” admits Roth. “But we’ve also got photos on a trail camera of Arctic foxes chasing red foxes away from their dens and photos of them sitting not two metres away from each other not caring at all. Overall, we don’t think that the red fox is causing the decline of Arctic fox numbers. We think it’s more likely that the red foxes are just benefiting from the Arctic fox decline.” Even so, the Manitoba biologists are monitoring the situation, filming the denning sites, collaring both species to compare their habitat use and movements, and collecting blood samples to compare diets and pathology.

Unfortunately, monitoring alone will not alter the fate of the Arctic foxes in northern Manitoba. “I would not be surprised if in my lifetime we don’t see Arctic foxes in the Churchill area anymore, or at least to any regular degree. I could be wrong, but that’s the way things are trending,” says Johnson-Bice. “That being said, they’re an adaptable species, and their range extends across basically all of the Arctic tundra, so I believe the species as a whole will survive.”

It’s a cruel irony that an animal markedly improving the biodiversity of a region is now suffering because of changes in that environment. How the Arctic fox will adjust to the relentless advance of climate change is open to debate, but based on its ability to overcome the challenges of its hostile environment and the historical ravages of human predation, its chances of finding a path forward seem like a fairly safe bet. 🐾

THE ARCTIC FOX
IS VIRTUALLY
INDESTRUCTIBLE
IN THE FACE OF
ANY WEATHER
THAT NATURE
CAN MUSTER





The fragile life
OF THE
Banff Springs
SNAIL

Tucked into a handful of hot spring pools in Banff National Park lives one of Canada's rarest creatures. The Banff Springs snail is no bigger than a popcorn kernel, yet its fight for survival has captured scientists' hearts for decades

By Mirjam Guesgen Illustration Chanelle Nibbelink



T

he first time

Brenna Stanford encountered the tiny residents of the thermal pools at Banff's Cave and Basin National Historic Site, she was entranced. "I remember watching them somewhat hypnotically," she says. "They'll kind of flutter along the tension of the water, and then they'll dip down to the bottom and come back up."

Stanford, now a conservation program manager at the Wilder Institute, the conservation arm of the Calgary Zoo, had been studying the genetics of the Banff Springs snail for her master's thesis. She had never given much mind to snails, let alone one that's easily overlooked because of its unpopped-kernel-of-popcorn size.

But that year, she fell in love with the snail, like so many others who had been introduced to this endangered Canadian-native before. "I just have a real fondness for them. It sounds so unscientific, but I just think they're special."

The Banff Springs snail boasts many lovable features, including being the only snail in North America with a shell that spirals left instead of right, coloured with paintbrush strokes of white, black and brown. But it's the sizable role this petite snail plays in its aquatic habitat that has researchers hooked. As an indicator species, which tells conservationists about how well an ecosystem is doing, the Banff Springs snail reflects the health of the fragile thermal pools it inhabits.

Dwayne Lepitzki is one such snail advocate and the self-proclaimed

world expert on the Banff Springs snail. The title is well justified. He's spent more than 30 years studying it, wrote its first official status report (which earned the snail its endangered status) and is the co-chair for the mollusc subcommittee of the Committee on the Status of Endangered Wildlife in Canada.

He first met the snail serendipitously in 1995 when Parks Canada was looking to renovate the upper part of the thermal springs in the Cave and Basin National Historic Site. "A manager came and said, 'Hey, just a minute, isn't that special snail supposed to be up here?'" Lepitzki recalls. The manager wanted to know more, and Lepitzki happened to be volunteering at the park at the time, having just completed his PhD on, you guessed it, snails.

"Until I showed up on the scene, no one really knew anything about it," he says. When I spoke to Lepitzki over the phone, he ran me through the snail's many ecological details. Every whorl, tentacle and organ of the snail is amazingly adapted to its harsh home.

Of the 11 thermal springs in the park, seven are home to Banff Springs snails. The pools are hot, upwards of 36 C, or the temperature of a hot tub. The pools are also full of dissolved sulphur, which gives the area its characteristic rotten egg smell and turns the water into a kind of acid bath. Below the surface, there's very little dissolved oxygen — regular fish wouldn't be able to pull much air from these waters.

And yet, the Banff Springs snail thrives here. Its miniscule lungs allow it to suck air up at the surface. Its suction-cup-like foot helps it cling to sticks, rocks and floating mats of algae. The dissolved minerals, bacteria and algae in the water — a product of the hot temperatures — become a feast for the snail.

"They're highly specialized to survive in this really extreme environment. They evolved right here in these springs," says Kate Keenan, a resource conservation officer with the Banff field unit of Parks Canada. In fact, the snails are found nowhere else in the world except for these half-dozen or so pools.



WITH SUCH WARM TEMPERATURES AND TEMPTING AZURE HUE, PEOPLE OFTEN WANT TO SWIM OR DIP THEIR FEET IN THE POOLS, DESPITE THE AMPLE SIGNAGE WARNING THEM NOT TO

That extremely restricted geographic range is part of why the snail is considered endangered. It also makes the snail extremely vulnerable to being wiped out completely. Any small disruption to its hot tub ecosystem and snail numbers drop.

This is evident every year, says Keenan, as the snail population fluctuates wildly between winter and summer. In the winter, the temperature of the pools is high, pH is low and an abundance of hydrogen sulphide fuels the bacteria the snails feed on. Prime Banff Springs snail conditions. The population booms at upwards of 4,000 snails in some pools.

“Everything around you is frozen and dormant and covered in snow. You go there and everything is so lush — still growing and thriving,” says Keenan.

Come spring, ice from the surrounding mountains melts, cooling and diluting the pools, and the minerals and bacteria along with them. Snail numbers plummet, sometimes to as low as a dozen or so in a single pool. “You’d think this would be making the habitat more friendly, but it’s actually disruptive for the snails,” says Keenan.

The yearly cycle is not so much cause for concern, according to Lepitzki. A bigger issue is disruption caused by people. With such warm temperatures and tempting azure hue, people often want to swim or dip their feet in the pools, despite the ample signage warning them not to. When people enter and exit the pool, they can break up the floating mats of algae holding the snails, stranding the animals above water. Chemicals from moisturiser or sunscreen can also upset the pools’ chemical balance.

Some areas are completely off limits to the public and under 24-hour surveillance. Still, there have been multiple incidents of people floating the rules. In 2015, an Ontario man bathed in one of the pools while smoking a cigar. “I didn’t hurt no snails,” he said at the time. He was fined \$4,500. Lepitzki notes the irony of summer being the prime tourism season and also when the snails are most vulnerable.

What’s even more worrying are the bigger, longer-term shifts brought on by climate change. Warmer temperatures and greater fluctuations in rain patterns mean pools are drying up more often. Lepitzki describes one pool, which no longer has any snails in it, that has dried up in 23 out of the past 30 years. “What used to be very uncommon, the spring drying up, is now becoming the norm,” he says. “Of course, being an aquatic snail, dependent on the water, if you’ve got no water, the snail will disappear.”

But too much rain can also be a bad thing, Lepitzki says. The years 2005, 2012 and 2013 saw major drops in snail numbers after inundations of rain (2013 being the year of the major Calgary floods). Just as during the spring melts, rain dilutes and cools the water, meaning the snail’s primary food source, bacteria, isn’t as abundant.

If any of these threats were to spell the end of the Banff Springs snail, it would be a shock to the ecosystem. “Just like any ecosystem, if you





EVERY WHORL, TENTACLE AND ORGAN OF THE SNAIL IS AMAZINGLY ADAPTED TO ITS HARSH HOME

remove an important component, it's going to change. It won't collapse necessarily, but it'll completely change," Lepitzki says. He explains that the snails are important grazers, eating bacteria and algae and pooping out materials that other organisms use as an energy source. Plus, the snails are eaten by waterfowl, garter snakes and amphibians, some of which are themselves endangered.

But Lepitzki says there's a philosophical aspect to the loss of the snail too. "The world is in a biodiversity crisis right now. Governments are scrambling to save species. What right do we have to say one species is more important than another one?" he asks.

The snail lives in an area the size of the defensive zone of a hockey rink, Lepitzki says. "If you can't protect something that

lives in such a small area, then what are the chances of humankind protecting species like caribou that require much more vast areas?"

The Banff Springs snail now has a veritable fortress of protections, including sitting within a national historic site, a national park and a United Nations Educational, Scientific and Cultural Organization world heritage site and key biodiversity area, as well as its endangered status under the national Species at Risk Act.

Day to day, these protections play out as protecting its habitat, monitoring its numbers and educating the public, says Keenan. Those protections are held in place because of its endangered status, one that Stanford's genetic work helped solidify when she demonstrated that the Banff Springs snail is its own unique species, separate from a more common one.

But unlike other protected creatures, most visitors to Banff National Park will never see this endemic marvel. It will probably never be a national symbol. And yet, the Banff Springs snail carries on.

"I find it remarkable that they go through these incredible increases and decreases every year and yet they persist," says Stanford. "There's something wonderful about the fact that these little thermal pools are their whole world. They're just there doing their thing. It's a beautiful type of life." 🐌



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BIRDING

Birds of a Feather

Grebes manage their harsh diet by eating the oddest thing ... their own plumage

ONE OF THE MOST FASCINATING

uses of feathers must surely be their deliberate consumption. Termed “autofeatherophagy” by ornithologists, the act of eating their own feathers is essential to the health and survival of aquatic diving birds known as grebes. The seven species in North America comprise the least, pied-billed, eared, horned, red-necked and the larger western and Clark’s grebes.

Why do they eat their own feathers? It has nothing to do with a nutritional deficiency or a compulsion acted upon in distress. It’s actually a highly sophisticated adaptation that helps these birds cope with their diet and lifestyle.

Grebes are mostly fish-eaters, occasionally supplementing their diet with crustaceans, amphibians and aquatic insects. Using their powerful legs armed with lobed toes and positioned far back on their bodies, they dive for food in both salt and fresh water using their slender, pointed bills to spear or snatch their agile, slippery prey. Grebes generally swallow their prey whole — prey that usually contain small sharp bones, indigestible scales and small mollusk shells. If not digested properly, these items could potentially irritate, puncture or damage the delicate linings of their digestive organs. As diving birds with very high metabolic rates, grebes also need to digest their food very rapidly and efficiently.

The issue is that their bodies aren’t built to handle their rough diet. Unlike many bird species, grebes do not have a muscular, grinding gizzard, often filled with grit. They rely on their feathers instead. These ingested feathers accumulate in the stomach, serving a dual purpose. Some gather in the pylorus, which is the entrance to the small intestine, and act as a filter to allow nutrients to pass but keep the hard indigestible matter in the stomach for further processing.

Many of the feathers line the stomach wall, forming a dense, felt-like mat to serve as a protective layer against the sharp edges of bones, scales, shells and insect exoskeletons. These materials embed themselves into

the feather mass, which eventually becomes regurgitated in the form of a pellet, similar to what owls and other raptors do. As the pellet works its way up the esophagus and out of the mouth, the feathery parts facilitate its movement and, at the same time, remove any harmful debris.

Where do they get the feathers? Besides finding loose moulted feathers floating near them, grebes actively and deliberately pluck them from their own plumage while preening. They even feed them to their young to instill this critical behaviour as early on as possible.

—DAVID BIRD



A red-necked grebe with a chick riding on top its back
Inset: pied-billed grebe

FIELD GUIDE

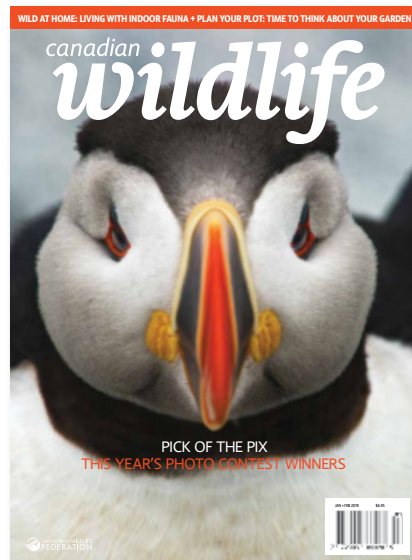
Common Hackberry

Celtis occidentalis

COMMON HACKBERRY (*CELTIS OCCIDENTALIS*)

is a largely overlooked tree in Canada because its wood isn't suitable for furniture-making. Yes, the wood is weak and likely to rot, but this hyper focus on timber quality has caused us to miss out on one of nature's most adaptable and ecologically valuable trees.

Common hackberry, also known as northern hackberry, beaverwood and false elm, is a resilient tree, ideal for planting in the suburbs and cities. Not only does the deciduous tree grow up to 15 metres high, providing excellent privacy screening, but it also establishes itself quickly. These trees grow fast and are built to last;



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common hackberry can live to the ripe old age of 150.

Thriving in hardiness zones 2 through 7, common hackberry can be spotted growing in the wild in Manitoba, Ontario and Quebec. You'll find these trees across an array of habitats: flood plains, rocky hillsides and stream banks. They are happy in all kinds of soil, from acidic to alkaline, clay to sandy. Whatever soil they live in, they need to grow in full sun to thrive.

In early spring, new leaves emerge in a mix of green and brown hues, measuring six to nine centimetres long. By October, the tree undergoes a remarkable transformation. The leaves turn a brilliant yellow, while the tree produces edible dark red and purple berries, each about the size of a pea. These berries contain a hard, pitted stone, surrounded by sweet, date-flavoured flesh that wildlife love to nibble.

When insects become scarce in the fall, many bird species will happily gobble up the tree's berries. Waxwings and robins, chickadees and woodpeckers, grouse and titmice all rely on the critical nutrition the berries offer through the cold winter. Small mammals like chipmunks and squirrels also include hackberry fruit in their winter diet. But the common hackberry's benefits go well beyond the berries it produces. The tree's canopy provides essential shelter for birds, small mammals and even deer. It is also a critical host plant for multiple species of butterflies, including the mourning cloak, hackberry emperor, question mark and tawny emperor.

As suburbs pop up across our landscape, the common hackberry is a valuable option, considering its tolerance for environmental stressors. The tree is resilient enough to withstand droughts, periodic flooding and exposure to air pollution and road salt.

Before considering common hackberry for your property, it's important to understand the trade-offs you might have to make. The tree produces numerous seedlings that might appear throughout your property. Many gardeners find themselves pulling up a lot of young trees. Common hackberry can also develop two conditions: nipple gall and witches broom gall. These are caused by insects and mites that create growths on branches and leaves. While these galls might stunt the tree's growth and berry production, they rarely threaten the tree's life. —MARY WHITTAKER

WHEN INSECTS BECOME SCARCE IN THE FALL, MANY BIRD SPECIES WILL HAPPILY GOBBLE UP THE TREE'S BERRIES

Hackberry leaf



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Snowplows clear and salt the Gardiner Expressway in Toronto

URBAN WILDLIFE

Five Million Tonnes of Trouble

Canadian winters demand road salt. Our waterways are paying the price

IN MOST PLACES IN CANADA, WE DON'T get just a light dusting of snow. We get blasted and buried in the stuff. When we finally brave the cold, we often find our driveways and roads slick with ice. It's no surprise then, that Canada uses about five million tonnes of road salt each year to combat these slippery surfaces. Since its introduction in 1938, road salt has become our go-to to combat winter's worst conditions. Unfortunately, it comes at a pretty terrible price.

Road salt doesn't simply vanish with the arrival of spring. Instead, it seeps into the ground, infiltrating our groundwater, and trickling into our lakes, rivers and

streams through runoff. Over the past decade, researchers have observed a troubling uptick in freshwater salinization in Canada.

During the winter of 2019 — 2020, researchers at Ottawa Riverkeeper collected hundreds of samples from fresh water throughout the National Capital Region and found shocking results. On the Ottawa side of the Ottawa River, Green's Creek, Mather Award Ditch, Nepean Creek, Nesbitt Creek and Pinecrest Creek all showed dangerously high chloride levels — the key component of road salt. Across the river in Gatineau, Cutter Creek, Des Fees Creek, Desjardins Creek, Moore Creek and Queen's Park Creek faced the same contamination.

Perhaps most concerning, 90 per cent of all samples contained dangerously high chloride concentrations. And not just in the winter. When researchers returned in summer — when road salt sits unused in storage — they found the same bodies of water to still be high in salt levels. That means when road salt enters our waterways, it tends to overstay its welcome.



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Bighorn sheep licking salt from the road, near Canmore, Alberta

Road salt also harms the species that call fresh water home. Freshwater fish don't flourish in increasingly salty conditions. Researchers have found that newly hatched rainbow trout weigh 25 per cent less when raised in salt-contaminated water than when raised in fresh water. This stunted growth compromises their ability to survive and reproduce successfully.

Amphibians and reptiles also face challenges due to road salt contaminating their watery abodes. Frogs and salamanders that rely on roadside ponds for breeding have lower egg-hatching rates. And many creatures, like turtles, simply cannot survive when salt levels in their habitat become too high.

While our freshwater species struggle with the increase of salt in their lakes, rivers and streams, some saltwater species think the water's just fine. In 2011, several blue crabs — typically found along Nova Scotia's coast — were found in Toronto's Mimico Creek. How they got there is still a mystery. But the crabs survived for days in the creek, signalling a concerning shift in ecosystem balance.

And it's not only freshwater creatures that are affected by road salt. Birds and mammals like moose, deer and elk are all naturally drawn to roadsides to access the salt they crave for their diet. While they're licking the salt, they're at increased risk of being hit by cars.

Our reliance on road salt becomes even more perplexing when considering its effectiveness. When temperatures dip below -10 C, a common occurrence in Canadian winters, road salt becomes largely ineffective, meaning we're causing environmental damage without creating safer driving conditions.

Other cold-climate countries have developed innovative alternatives and solutions. Japan uses sensor networks to track road conditions in real-time, allowing crews to send plows out early to prevent ice from forming before it needs salt treatment. Sweden and Finland use sand and ash to offer some traction on icy roads. Iceland's capital, Reykjavik, harnesses geothermal energy to melt snow directly on roadways, eliminating the need for chemical de-icers.

Engineers are also offering new solutions. In recent years, porous pavement has proven to be promising, as it can absorb snow and prevent ice formation. Research shows this technology can reduce road salt requirements by a whopping 77 per cent.

While we await large-scale infrastructure changes, Canadians can make a difference on their own properties. Before winter arrives, ensure downspouts are directed away from walkways to prevent ice buildup. When Old Man Winter rears his ugly head, try to shovel promptly after a snowfall to prevent snow from hardening into ice. Choose sand or ash instead of salt for traction on your driveways and walkways.

—APRIL OVERALL

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Canadian Centre for
**Nature-based
Education**



INTRODUCING:

the Canadian Centre for Nature-based Education

Nature is our nation's greatest teacher. We can learn about science, math, survival, co-operation, growth, leadership, health, wellness and many other skills through our connections to the outdoors. But did you know that Canada did not have a national centre for nature-based education until now? The Canadian Wildlife Federation has just launched this amazing revamp of its award-winning programs to inspire more Canadians to get out and about. Mike Bingley, director of education for CWF, tells us more.

1 | Why is CWF creating a centre for nature-based education?

Conservation begins with learning. People are at the heart of every conservation challenge in the triple crisis of biodiversity loss, climate change and pollution. Since CWF's beginning, we've worked to help people know that they can have a positive impact and we've helped them do it. We've had a lot of success. In the past five years, we've had meaningful conversations with more than a million people across the country. But the challenges that we face are too big for any one organization to take on alone. We need to act fast and at scale if we are going to make the difference that we need to make.

The Canadian Centre for Nature-based Education is going to help make this change. It's a new approach where we are going to work with partners from across the country to build on the skills that already exist in communities, give some support to the great things that are happening, and focus our direct work on the things that communities really need that we are in the best position to do. We are going to make sure that we don't turn anyone away who wants to get involved: if we can't help them directly, we're going to introduce them to someone who can. This is a bit different, but we think that a centre focused on collaboration, rather than competition, with other groups and individuals doing great work in the environment is the only way that all of us are going to be able to meet the growing challenges that Canada and the world face right now.

2 | Does this mean that CWF is going to stop delivering education programs?

Far from it! We believe that if you are going to challenge others to do better, you have to challenge yourself to do better too. We're going to continue the work that we've been doing for more than 40 years training educators through WILD Education, helping students create habitat and biodiverse learning spaces in their schools with WILD Spaces, and helping to make sure that young people have a chance to make a real impact in their communities with our award-winning WILD Outside and Canadian Conservation Corps programs. But we're also going to be working with community groups across Canada to build on local strengths. We're going to align this work around the National Environmental Learning Framework that is being developed through a partnership of NGOs and governments across Canada that focuses on key priorities including:

- Hands on nature-based learning embedded in schoolyards, communities and public green spaces across Canada
- Equity-driven access to outdoor education for Indigenous, rural, urban and underserved communities
- Career connected learning that builds green skills and supports Canada's transition to a sustainable economy
- Training and support for educators to integrate conservation, climate actions and biodiversity education with confidence
- National co-ordination and impact tracking to align efforts and measure progress on environmental literacy and stewardship
- Funding for nature-based education across Canada

3 | What excites you most about launching the Canadian Centre for Nature-based Education?

I'm really excited that we are going to be able to shine a light on some of the outstanding programs and initiatives that are already taking place in Canada and quantify the impact that they are having. There are small local groups doing amazing work like the Wildsight EcoStewards in Elk Valley, BC that pair high school students with local conservation projects or Nature New Brunswick's Nature Clubs that are making a real difference in that province. I'm excited that we are going to be able to refer people to programs like these ones, advocate for our shared interests, and continue to inspire conservation in Canada.

4 | What does the future of nature-based education in Canada look like, and how will the Centre help shape it?

I hope that the future is going to be one where we reach across sectors to share knowledge and connect Canadians to our natural environment. I'm not going to rest until everyone in Canada has the opportunity to learn for, about, and in nature! The centre is going to help make that a reality by giving a voice to the community. We're going to help people find like-minded people and make big goals possible. It means that we are going to make

some mistakes along the way and we're going to have to tell people what we've learned from them. It means that we are going to have to trust each other and hold each other accountable. By doing this, we are going to see all of our math, literacy and science knowledge improve and we are going to tackle biodiversity loss, climate change and pollution. This is going to bring all of us a bit closer together, helping to build our places in our own ways, and learning along the way.

5 | How can we find out more and get involved?

We're building this centre to thrive on collaboration. NGOs, government entities, foundations and other groups in the nature and/or education space that share our belief in the power of partnership and nature-based education are invited to get involved. And whether you're a teacher, a youth leader, a community volunteer, or simply someone who loves nature, there's a way to take part.

We are going to be running workshops across Canada, starting in Alberta, New Brunswick, Ontario and Quebec to help us understand those communities, but you can connect with us in other ways as well – partner with us to co-host a local event, share expertise and strengthen outdoor learning opportunities for youth.

Getting involved is going to start first with curiosity. Be curious about your neighbourhood, no matter where it is, and help us build a community effort that will create nature-based learning for all.

You can connect with us at ccnbe.ca to find out more, join our mailing list, register your interest in local programming, or contact us directly about partnerships.

..... Some of the Founding Partners of the Canadian Centre for Nature-based Education include:



Right Here



50° 12' 40.4" N
63° 47' 34.7" W

Monoliths of Île Quarry
Mingan Archipelago National
Park Reserve, Que.
Photo by Anne Richard

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